

SOME ASPECTS OF THE ECOLOGY AND BEHAVIOUR OF THE INDIAN FOX—*VULPES BENGALENSIS* (SHAW)¹

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This brief report on the Indian Fox (*Vulpes bengalensis*) is based on intermittent observations in the grassy plains and rocky areas lying to the North West of Nanguneri (8°30'N and 77°70'E) in Tirunelveli District, Tamil Nadu. The foxes inhabiting the open lands littered in complex cavernous dens with many entrances but in the rocky area dens dug under the rocks and into the rock crevices were preferred. The pups were observed to frequently play around the den entrances in the months of April and May, when they were around 2-3 months old. Though the Indian Fox is a solitary hunter it seems to be more sociable in nature. Hunting was mostly done early in the morning, late evening and night. Insects and terrestrial rodents formed the staple food of this canid. The Indian Fox was observed to tolerate the presence of the common mongoose (*Herpestes edwardsi*) in the vicinity of its den. Mortality was mostly due to man and dogs. The future of the Indian Fox in the rocky area appears to be safe.

INTRODUCTION

The Indian Fox, *Vulpes bengalensis* (Shaw), is the common fox of the Indian plains found in the whole of India from the foothills of the Himalayas to Cape Comorin (Prater 1971). Its successful survival is presumably due to its small size, reproductive capacity, denning and feeding habits and its general adaptability. The Indian Fox, though common in the study area, is absent from the neighbouring Western Ghats, which rise 16 km away in the west. The probable reason for this could be that foxes as they chase and hunt small prey such as insects and rats are more adapted to hunting in the plains than the vegetation covered hills. Like other foxes, the Indian Fox is also a solitary hunter. Although common in India, within my knowledge, not much work has been done on

this animal. The study presented here is a preliminary attempt made on some aspects of the ecology and behaviour of this canid.

STUDY AREA AND METHODS

I have been familiar with the Indian Fox for over the last fifteen years in the field but only from the summer of 1974 did I start observing and studying them intensively. The observations could only be sporadic as the study area was visited only during the holidays.

The study area was the grassy plains with rocky hillocks, lying to the North-West of Nanguneri (8° 30' N and 77° 70' E) in Tirunelveli District, Tamil Nadu. This is a good habitat for the Indian Fox and sighting of foxes is assured to any one who walks in this area either in the early morning or late in the evening. Temperature data for Nanguneri which lies 17 km East to the Kalakadu hills of the Western Ghats are not available. But the temperature of the nearest town Palayamkottai, 29 km to the North, varies between 24°C and 40°C. The area gets most of its rain from the North East monsoon and most of the rainfall

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is between the months of October and December. The precipitation varies between 50 and 70 cm per year. (Sivasailam, Pers. Communication).

I concentrated my study on two areas. One was a square kilometre open land with four waterless sandy streambeds meandering through it. On the western and Northern sides of this plot are fields; on the eastern side the Kasi-Kannyakumari Trunk Road and on the southern side an industrial complex. From dawn to dusk, the area was intensively disturbed by cattle, sheep and people. An average of 2-4 adult foxes were seen in this area. In total, the area had 8 dens, both old and new. The other area selected was rocky and was surrounded by a vast plain, dotted with palmyra palms (*Borassus flabellifer*) and rocky outcrops. This area has been a favourite home of foxes for years.

Observations were made mainly in the evening and some times in the morning. A total of approximately 60 hours was spent in the field in search and observation of foxes. In the open land the foxes were observed from the cover of bushes or by stalking upwind. The den among the rocks was easy to observe as I had a suitable hideout in the neighbouring rock outcrop. But observations were possible only when the wind was in favour. Occasionally droppings from the den sites and nearby areas were collected to study the food habits. Two foxes killed by dogs were examined for parasites and stomach content. My observations on the pups were mainly carried out in the summer of 1976. When I was successful in locating 5 active dens inclusive of the two from the study area. Of the rest, two were among the rocks and one amidst hardened sand outcroppings on the banks of a sandy stream bed.

The flora of this semi-arid area is spiny and

many have milky latex characteristic of desert plants. Common trees were the palmyra palm (*Borassus flabellifer*) and *Acacia planifrons*. The exotic thorny shrub *Prosopis juliflora* had also established itself successfully. Common herbs were the *Calotropis gigantea*, *Cassia* spp. *Alysicarpus parviflorus*, *Triumfetta rhomboidea* and *Barleria* spp. *Aristida setacea*, *Aristida hystrix*, *Perotis indica*, *Heteropogon contortus*, *Tragus biflorus*, *Chloris barbata* and *Cyanodon dactylon* were the common grasses.

RESULTS AND DISCUSSION

Food and feeding habits

My observations on the feeding habits of the Indian Fox were limited by the fact that they were crepuscular and nocturnal. The most widely applicable statement that can be made safely is that foxes are opportunistic feeders and so take any acceptable food in proportion to its availability (Ables 1975). Melons, ber fruit, and the shoots and pods of *Cicer arietum* are eaten in season (Prater 1971). Local shepherds have seen the foxes eating the freshly voided pellets of sheep. They were seen hunting insects such as the winged termites and grasshoppers. They used their jaws to snap them in the air and their forelegs to pin them on the ground. Stomach analysis of one fox showed that they eat beetle grubs and of another showed only the hairs of the soft furred Field Rat.

From scat analysis it was found out that the food of the Indian fox was mainly composed of beetles, grasshoppers, crabs, ground lizards, soft furred Field Rat and Field Mouse. Occasionally, they ate scorpions (*Buthus* spp.), ants (*Componotus compressus*), termites (*Acanthoptermes* spp.) and spiders. A search around the dens yielded the scales and ventral plates of a Ratsnake, the skin of the Hedgehog, fea-

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COMMON VERTEBRATE FAUNA OF THE STUDY AREA

Common name	Scientific name	Remarks
Garden lizard	<i>Colotes versicolor</i>	Probable food
Fanthroated lizard	<i>Sitana ponticeriana</i>	Probable food
Rock lizard	<i>Psammophilus</i> sp.	Probable food
Grey Partridge	<i>Francolinus</i>	Occasionally roosts on the ground
	<i>Pondicerianus</i>	Probable food
Redwinged Bushlark	<i>Mirafra erythroptera</i>	Probable food
Blackbellied Finchlark	<i>Eremopterix grisea</i>	Roosts on the ground. Probable food
Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	Roosts on the ground
Indian Myna	<i>Acridotheres tristis</i>	
Indian Pipit	<i>Anthus novaeseelandiae</i>	Roosts on the ground. Probable food
Little Ringed plover	<i>Cheradrius dubius</i>	Local Migrant
Cattle Egret	<i>Bubulcus ibis</i>	?
Indian Courser	<i>Cursorius coromandelicus</i>	?
Hedgehog	<i>Paraechinus nudiventris</i>	Probable food
Softfurred Field Rat	<i>Millardia meltda</i>	Probable food
Three stripped Palm squirrel	<i>Funambulus palmarum</i>	Probable food
Field mouse	<i>Mus booduga</i>	Probable food
Blacknaped hare	<i>Lepus nigricollis</i>	Young ones Probable food

thers of the Indian myna, Blackbellied Finch Lark and Grey Partridge. As the foxes groom and bite themselves to get rid of the ectoparasites there is a possibility, as evidenced by faecal analysis, of their swallowing their own hairs. Besides the hairs, the hard bones, teeth, chitinised mandibles, insect legs, elytra of beetles, wings of grass hoppers and fragments of grasses formed part of the droppings. In general it can be said that the food of the Indian fox in the study area was mainly composed of insects, ground nesting birds and smaller mammals. The small size of the prey is the major possible reason for the fox to be a solitary hunter. In fact, the expenditure of energy of two or more foxes cooperating to kill one mouse would be maladaptive (Fox 1975).

Droppings of the cubs, that had not started following the adults for hunting, mostly had

digested meat, and hair of either the soft furred Field Rat or the Field Mouse. This suggests the possibility that their principal diet was of milk and small rodents brought to the lair by the adults.

Dens and denning behaviour

The dens of the Indian Fox could be grouped into three types: 1) Simple short dens with two openings; 2) Complex cavernous dens with many entrances; 3) Dens under rocks and rock crevices.

One den belonging to the first type was seen in the study area in the open land. Its interior was 45 cm long, 40 cm broad and 30 cm high. This was seen at the edge of a man-made pit. Obviously such dens are used for brief periods of rest. Such short and simple dens could be called 'cooling holes' or protective 'bolt holes'. But this type of den was rare.

The second type was the commonest. In the

one square kilometre study area there were eight such dens. During the non-breeding season all the dens had a deserted appearance and during the breeding season, as the need rose, the dens were freshly dug out. The number of entrances varied between 6 and 23. In the number of den openings the early observations done on the other species of foxes can be recalled here. The Alaskan fox had dens with upto 19 entrances (Murie 1944), the Red Fox in North America had 12 or more openings (Ables 1975) and the Arctic Fox in North Alaska has 26 entrances (Chesemore 1969). Two dens were on sand mounds. Owing to the grass cover, the dens dug on the plains were mainly hidden from view at a distance. But on going nearer the den, one may be attracted by the sand thrown at the entrances, especially with the arrival of the breeding season when foxes reexcavate their dens. The structure of such a complex den is described by Prater (1971) and it needs no further elaboration here. As there are many holes leading into such a complex den, the interior is presumably well ventilated and is certainly not in total darkness. Most of the abandoned den openings were clogged by wind-blown grasses and debris. Vegetation in the area of a complex cavernous den appeared slightly better than that of the surrounding area. This phenomenon more prominently seen in the den site of the Arctic Fox (*Alopex lagopus*) has been noted by Chesemore (1969). According to him the change is due to the addition of organic materials to the soil plus the physical disturbances, aeration and mixing of the soil that occur when a fox digs and uses a den site.

The Indian Fox seems to be attached to favourite den sites. According to Murie (1944) and Ables (1975) there is strong evidence that adult Red foxes in North America remain in the same home area for life. The dens report-

ed by Ables (1975) were used more or less continuously for periods of at least 35 years. He says that such dens are traditional and are at a premium because of the scarcity of suitable sites. The den among the rocks in the study area was seen tenanted for well over 15 years, and in the study area in the plains, in spite of the growing disturbance, the foxes preferred to stick to their den sites. One den site, which was active in the summer of 1976, had six openings and was about 70 metres from a cart track that was often used by pedestrians, cyclists and occasionally by heavy traffic. The foxes, when disturbed while resting away from the dens, very often took refuge in the den instead of running away. Some of the dens, dug out in hard-baked earth, gave the foxes needed protection from the piedogs which are their main enemy besides man in the study area.

The Indian fox also has the habit of sleeping under bushes during the hot hours of the day. Such places are easily identified by their concavity, absence of grass and by the presence of well churned fine sand. Such places could be called 'cool earth pits'. The Indian fox does not seem to be particular about den cleanliness as their den surroundings were littered with their droppings, especially when the dens were occupied.

Reproduction, family unit and home range

In the Indian Fox there appears to be a persisting bond between the members of a pair. This is based on three sightings of the pair of foxes. Twice they were seen in the month of April (post reproductive period) and once in September (pre reproductive period), when the pair was observed in April once the vixen was lying fully stretched on the ground and the male lying nearby nibbled at the pinna of the female. But when the time for hunting came both parted. Further study is needed to confirm the valid evidences for or against this

speculation. According to Acharjyo & Misra (1976) mating in the Indian Fox is just as in domestic dogs. The birth of the young in the Indian Fox, as in all wild canids occurs with maximum availability of prey that is, when the latter are rearing their young and in the study area this happens around January. During this season the lush vegetation after the North East Monsoon affords not only cover but also abundant insect food. The gestation period lasts for 53 days (Prater 1971), 50-51 days (Acharjyo & Misra 1976) and usually 2-4 young ones are born. The vixen observed by Acharjyo & Misra (1976) gave birth to 4 pups towards March end. Both the active dens in the study area had four pups each.

The age of the pups in the beginning of the observation period was nearly 2 months and observations were carried out till the pups were almost 4 months old. The pups were very playful till they were 3 months old. The male was observed with the pups four times. During this only once did the male rebuff a pup, which attempted to play with it, with a growl and an inhibited bite. At all other times the male played with the pups. The inhibited bite of the male on the pup suggests the possibility that the male was confirming its dominance over it.

During the observation on the play behaviour of the pups, I watched them making vertical leaps, back-arching, hip and shoulder body slams, foreleg stabs, and submissive display by rolling on the back and exposing of the throat. Play soliciting was common. Occasionally, the pups left their play—partners abruptly and indulged in digging up the soil. The pups in the open land used to remain immobile while watching the pedestrians, cyclists, cattle, sheep and the occasional stray dogs which sometimes went as close as 30 metres. But on the least suspicion the pups always ran

inside. While coming out of the den in the open land the pup that came out first always looked around, keeping the head level with the ground. Once it had come out, other pups mostly followed it without looking around. Twice the pups were watched while defecating. They moved 4-5 metres from the den and defecated. The African wild dog pups observed by Kuhme (1965) defecated one or two metres from the entrance.

The pups in the openland den seldom played in the absence of adults. But the pups of the rocky den were full of play even in the absence of the adults. This may be due to the confidence engendered by the safe position of the den. The Red Fox in mid-wales in Britain will move pups with little provocation (Lloyd 1975) and as reported by the local people this is said to occur in the Indian Fox also. Other canids that shift the dens are the African wild dog (Kuhme 1965; Schaller 1972; H. & J. Van Lawick - Goodall 1970); the wolf (Muirie 1944; Mech 1970), the Indian Wild Dog (pers. observation) and the Indian Jackal (Samuel, pers. communication).

On the evening of 24th April 1976 four pups were being watched beside the den in the open land. At 1830 hours a female came out of the den and all the four pups ran to it and were suckled for half a minute. Then came out another female. The pups leaving the first female ran to it and were suckled for 2 minutes. From the den a male also came out. This type of suckling behaviour has been observed in the bat-eared Foxes (*Otocyon megalotis*) (H. & J. Van Lawick-Goodall 1970), in African Lion (Kruuk 1972, Schaller 1972), in African wild dogs (Kruuk 1972, Schaller 1972, Kuhme 1965).

There could be two possible reasons for the two females to have suckled the 4 pups. One reason could be that both the females might

have littered in that den and the entire surviving bunch of pups was being fed by both the vixens. The other reason could be that one mother could have lost all her young in the early postnatal period and it could have 'helped' the other in raising the litter. Another time, in the rocky area five almost full grown foxes, probably of the same family, were sighted resting under a rock in the noon day sun. Aggregations like this suggest the possible fact that the Indian Fox is sociable in nature.

In the open land study area, in the summer of 1974 there were two breeding pairs. In the nearby Farm forest which lies barely 100 metres from the study area on the eastern side there was another active den. In such areas there is a liability for the home ranges to overlap and a possibility for conflicts too. But as interpreted by Leyhausen (1965) these conflicts may seldom arise.

Communication in the Indian Fox:

The common vocal sound produced by the Indian Fox is the chattering cry which may be used as an alarm call also. Besides, they growl, whimper, whine, and they make a sound which could be called a growl bark. Once a male was seen urinating like a domestic dog but there was no smelling ceremony preceding it. The Gray Fox (*Urocyon cinereoargenteus*) defecates along road sides in or beside trails often in small concentrations. These scent posts may aid them in marking territories (Trapp 1973). Other animals that have been observed to defecate at specific latrine sites are the spotted Hyena (Kruuk 1972) the members of a banded mongoose group (Schaller 1972) and the Indian Wild dog (pers. observation). The Indian fox does not defecate in particular places or in small groups. Whether they use their droppings for communication is to be examined.

Behaviour of the Indian Fox:

The Indian Fox moves around at dawn and in the evening. In the hot hours of the day they retire to cover. If the temperature is mild as in rainy days, they hunt even at midday. Twice during hot weather a pair was seen resting in their hiding place close by a water hole. Often they were seen spending considerable time lying on the rocks or other vantage points, basking in the rising or setting sun. The Indian Fox usually waited for darkness to descend before starting its evening hunt. But the cessation of a downpour and a cloudy day brought it out of dens even in midday.

Once they get used to the farmers and shepherds they do not get easily frightened. Local shepherds have seen them playing with their sheep and the yelling of shepherds from a distance of 200 - 300 metres did not make them scurry into their dens. When cornered in a rocky terrain, a fox crouched flat on the ground trying to escape attention. Foxes do have a fairly good sense of smell and once a male smelt me hiding 10 metres away.

Foxes do not run long distances to capture prey but to escape from dogs they run fast and long. When chased by dogs their speed is remarkable. They seem to adjust their speed in accordance with the chasing animal. When it was a man they ran slowly and when it was a dog they ran fast. While running fast the tail was kept horizontal and the foxes were able to deceive many times the chasing dogs by dexterously twisting the black bushy tail. Possibly, this was achieved by misdirecting the bites of the chasing dogs and in quick turnings, naturally, the bushy tail gave one direction while the body went in the other direction.

Interspecific relations:

The rocky den area was inhabited by the Rock-lizard (*Psammophilus*), Three Striped Palm squirrel (*Funambulus palmarum*) and

Common mongoose (*Herpestes edwardsi*). The den of the mongoose was 10 metres away from the fox den that was under observation. The Palm Squirrels which nest in the nearby palmyra palms and Euphorbia (*Euphorbia antiquorum*) often came very close (3 - 4 metres) to the playing and resting foxes but they were very wary. The squirrels are potential prey and were afraid of the foxes and this was indicated by the fact that whenever the foxes went down from the rocky den the squirrels feeding closeby on the ground ran for safety sounding their alarm call.

The Common mongoose which weighs around 2 kg and the foxes were afraid of each other and they lived in 'armed neutrality'. The mongoose which can prey upon a half grown black naped hare (personal observation) occupied the same ecological niche as the fox and seemed to live without any major conflict. Once near the rocky den a full grown fox was sitting and grooming. A half-grown mongoose, feeding nearby, suddenly rushed at it forcing it off. Latter the fox followed the mongoose and twice charged at it. The first time the mongoose ran off screeching but the second time when the fox attacked, the mongoose crouched defensively and bristling its tail hairs fended off the attack.

The Indian Fox was indifferent to Cattle Egrets (*Bubulcus ibis*) and the latter also were not unduly alarmed when the foxes moved about in their proximity. Once a cattle Egret, that had been shot, was left by the side of the rocky den but it did not interest the vixen and her two cubs playing nearby. But a Common mongoose, as soon as it came out of its den, dragged the cattle egret into its den but by this time the foxes had retreated into their den.

The Yellow-wattled Lapwing (*Vanellus malabaricus*) and the Indian Myna (*Acridotheres*

tristis) were overtly alarmed by the Indian Fox and whenever the foxes moved about in their vicinity they flew off with their characteristic alarm call. The Indian Robin (*Saxicoloides fulicata*) which nested in the nearby *Euphorbia antiquorum* gave its warning notes whenever the foxes passed close to its abode. An Indian pipit (*Anthus novaseelandiae*) in the act of feeding, once went nearer (3 metres) to a male fox resting in the shade of a rock from the morning sun. But the fox simply eyed it without making an attempt to pounce on the bird.

Dangers and early mortality

In the study area the major danger to the fox comes from man especially from the nomadic *Narikuravas* and dogs. Occasionally the *Narikuravas* visit the area and with their ability to mimic the sound of foxes they easily net and kill the foxes for flesh, teeth, claws and skin. They also use hand made animal-fat-covered country bombs to kill the foxes. Further danger comes from the local 'hunters' who do not hesitate to shoot at or attempt to kill this small canid with their dogs. In summer, 1976, the active den of the Farm forest had 3 young pups but the mother was killed by dogs. My efforts to trace the fate of the pups were not successful. In the same summer, towards the end of my observation period, I found most of the entrances to the active den in the open land, where I had watched the four pups, two females and one male, jammed with stones. There was no trace of the foxes. Early mortality owing to natural causes may also be a danger to their lives. During the first week of April in the summer of 1975, the den among the rocks had 3 pups but around the end of May I continued to see only one pup. Two Indian Foxes killed by dogs were checked for macro endoparasites but none were found. This does not mean that the

foxes were devoid of endoparasites. The Indian Fox has the habit of biting often at places like the base of the tail and this may be due to infection of ectoparasites.

Any account of the Indian Fox ecology will be incomplete without considering the economic values, both positive and negative. On the negative side, predation on Partridges and young Hare which are valuable small game can be considered. Foxes are potential carriers of rabies. There is record of the Arctic Fox in Alaska having rabies during high population period (Rausch 1958). But there was no local report of the Indian Fox suffering from or transmitting rabies. Further there was no local record of the Indian Fox raiding either poultry or attacking sheep.

On the positive side, foxes prey on rodents, land crabs and insects which cause considerable damage to our crops. At present a balance sheet would probably show the Indian Fox with more positive values. While judging from my findings it would appear that the vermin status of the Indian Fox as declared by the wild life Act 1972 is unjustifiable. Prater (1971) is also of the opinion that the Indian Fox by its constant destruction of rats and land crabs does real service to the farmer. In-

tensive studies on this aspect of the Fox ecology in other parts of the country are urgently needed to re-avaluate its status.

Finally while mentioning about the future of the Indian Fox in the study area it can be said that before the ill-informed local people and the rapidly expanding human exploitation of the habitable areas one cannot be optimistic about the survival of the Indian fox tenanting the open land. But the rugged terrain of the rocky area, being suitable neither for cultivation nor for human settlement, hopefully may continue to give safety to and support a population of the Indian fox for many more years to come.

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